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Grouping Promotes Equality: The Effect of Recipient Grouping on Allocation of Limited Medical Resources

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Abstract

Decisions about allocation of scarce resources, such as transplant organs, often entail a trade-off between efficiency (maximize total benefit) and fairness (divide resources equally). Three studies using a hypothetical transplant organ allocation scenario examined allocation to groups vs. individuals. Study 1 demonstrates that allocation to individuals is more efficient than allocation to groups. Study 2 identifies a factor that triggers the use of fairness over efficiency: presenting the beneficiaries as one vs. two arbitrary groups. Specifically, when beneficiaries are presented as one group, policy makers tend to allocate resources efficiently, maximizing total benefit. However, when beneficiaries are divided into two arbitrary groups (by hospital name), policy makers divide resources more equally across the groups, sacrificing efficiency. Study 3 replicates this effect using a redundant grouping attribute (prognosis) and finds evidence for a mediator of the grouping effect – the use of individualizing information to rationalize a more equitable allocation decision.

Introduction

Many decisions require allocation of scarce resources. For example, there are fewer available transplant organs than individuals who need them (Organ Procurement and Transplantation Network, 2014). Such decisions frequently entail a trade-off between equity and efficiency (Ubel, DeKay, Baron, & Asch, 1996a), and perceptions of fairness play a key role (see Tong et. al. 2010 for a review of the public's preferences concerning organ allocation). Perceptions of equity or fairness, however, are influenced by subtle features of question presentation (e.g. Ubel, Baron, & Asch, 2001). In the current studies, we examine whether simply placing beneficiaries in groups prompts decision makers to allocate resources more equally across the groups.

Previous studies (Ubel, DeKay, Baron, & Asch, 1996a; Ubel, DeKay, Baron, & Asch, 1996b; Ubel & Loewenstein, 1996) indicate that decision makers faced with hypothetical organ allocation scenarios often do not allocate organs in a way that maximizes survival. For

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Authorship
All authors developed the study concept and contributed to the study design. Programming and data collection were performed by H. Colby. G.B. Chapman performed the statistical analyses. H. Colby drafted the paper and J. DeWitt and G.B. Chapman provided critical revisions. All authors approved the final version of the paper for submission.

example, when asked to allocate organs between a group of patients who had an 80% chance of transplant success and a group with a 70% chance of success, a minority of participants gave most of the organs to the better prognostic group. When the difference in prognoses between the two groups is larger, participants are more willing to favor the better prognostic group (Ubel & Lowenstein, 1996), but the maximally efficient response of giving organs to everyone in the better prognostic group remains rare.

These previous studies have uniformly presented participants with the task of allocating organs across groups of patients (e.g., Baron, 1995). Ubel and Loewenstein (1996), however, report that the majority of their participants indicated that they would not ignore prognostic information that could be used to rank individuals; indeed, participants indicated a greater willingness to use individual-level prognostic information than group-level prognostic information. No previous study, however, has actually compared organ allocation decisions when participants are given group- vs. individual-level prognostic information.

The grouping literature has extensively examined what creates the perception of different groups, from the original Robber's Cave study (Sherif, Harvey, White, Hood, & Sherif, 1961) showing that simple group names can foster group identities so valued that they led to summer-long conflict, to Swann et al. (2014) who examine how the perception of shared traits can lead to group identity strong enough to die for. While these studies demonstrate that even subtle manipulations can lead to strong group perceptions, they do so using the perspective of the group members themselves. In contrast, in the current studies participants are third-party observers who distribute resources across the groups.

In the current studies we first compare allocation of organs to groups vs. individuals. We predicted that fairness considerations would be more salient when allocation was made at the group level and risk information was presented at the group level. Next, we examine whether the use of fairness rather than efficiency is triggered simply by presenting the individual beneficiaries as one vs. two arbitrary groups. Specifically, we find that when beneficiaries are presented as one group, policy makers tend to allocate resources efficiently, maximizing total benefit. However, when beneficiaries are divided into two groups, policy makers divide resources more equally across the groups, sacrificing efficiency. A final study investigates a potential cause of this grouping effect, demonstrating that when decision makers perceive the possible beneficiaries as members of separate groups, they appeal to the individual characteristics of the beneficiaries to justify their allocation decisions.

Study 1

In the first study, we compared allocation of organs to groups (the method used in previous studies) to allocation of organs to individuals. We also investigated the effect of presenting risk information at the group level (the method used in previous studies) or the individual level.

Method

Participants (N=470, 40% female, mean age 32) recruited from Amazon's Mechanical Turk Marketplace (MTurk) responded to a scenario about allocating six kidneys across 12 patients in need of a transplant. An additional 42 participants were excluded from analyses for incomplete responses. Participants were shown a three by four grid of the 12 patients (Figure S1), with each patient identified by a photo and first name. The patients were divided into two groups of six via a line down the center of screen. The six patients on the left half of the screen were described as having a high likelihood of transplant success, with the six on the right having a low likelihood. Thus, the most medically efficient allocation was to give the kidneys to the six high-likelihood patients on the left.

Participants were randomly assigned to condition in a 2 × 2 design. One factor manipulated whether likelihood of transplant success was conveyed at the group or individual level. In the group likelihood condition, the labels "Chance of Success: High" and "Chance of Success: Low" appeared over the left and right groups, respectively. In the individual likelihood condition, there were no group labels. Instead, "chance of success: high" appeared under each of the six patient photos on the left of the screen, and "chance of success: low" appeared under each of the six patient photos on the right of the screen.

Orthogonally, we also manipulated whether participants allocated kidneys at the group or individual level. Those in the group allocation condition distributed kidneys to each of the two groups by typing numbers into text boxes above the groups (with the constraint that the two numbers sum to six). Those in the individual allocation condition clicked "give kidney" or "don't give kidney" for each of the 12 patients (with the constraint that they must give kidneys to six patients and deny them to the other six). When a patient was selected to receive a kidney, an image of a kidney appeared on their photograph, and when a patient was selected not to receive a kidney, a red × appeared. Note that the group likelihood / group allocation condition is analogous to the procedure used in previous studies (Baron, 1995; Ubel et al., 1996a, 1996b).

Results and Discussion

A 2 × 2 logistic regression on percentage of participants who allocated all kidneys to the patients with a high likelihood of success revealed that allocation decisions were more efficient when likelihood of success was communicated at the individual level (64% vs. 46% of participants allocated efficiently in the individual vs. group likelihood conditions, respectively), X^2=17.49, lnOR=0.41, 95%CI [0.22, 0.60], p <.0001. In addition, allocation decisions made at the individual patient level (where 64% were efficient) were more efficient than those made at the group level (47%), X^2=13.09, lnOR=0.35, 95%CI [0.16, 0.54], p =.0003. There was no interaction, X^2=1.18, lnOR=−0.11, 95%CI [−0.30, 0.09], p =.28 (see Table 1).

Whereas previous research on organ allocation decisions has presented information on likelihood of transplant success at the group level and asked participants to allocate organs to groups of participants, the current study illustrates that decision makers use organs more efficiently when they operate at the level of individual patients. This result has important implications because allocation policy decisions are made at the group level, but actual organ allocation decisions are made at the individual level. Our results suggest that the responses of participants in the studies by Ubel and colleagues (1996a, 1996b) were particularly inefficient because the questions prompted them to allocate at the group level.

The current study indicates that thinking about patients as individuals vs. as part of a group influences whether decision makers seek to maximize the benefit gained from the organs or whether they seek to spread the scarce organs somewhat evenly across the two groups. We explore this possibility directly in the subsequent studies.

Studies 2 and 3

In Studies 2 and 3 we used the individual likelihood / individual allocation condition employed in Study 1; however, we manipulated whether the patients were presented as one unified group (and hence treated as individuals) or whether they were divided into two groups. We predicted that fairness concerns would be more salient in the grouped condition and that consequently efficiency of allocation would decline in this condition.

Methods and Results

For Studies 2 and 3, MTurk participants responded to a kidney allocation scenario like that in Study 1. The 12 patients were presented as one group (unified condition) or as two groups of six (grouped condition). In the unified condition, a title was centered above the images. In the grouped condition, a black vertical line separated the two columns of patients on the left from the two on the right, with a title presented over each group. In each study, the grouping was confounded by design with likelihood of transplant success, such that all patients in one group had a high likelihood of success, while all those in the other group had a low likelihood of success.

Study 2

In Study 2 we manipulated whether the patients were presented in a grouped or unified format and also whether they were presented with identifying information. Participants (N = 246, 52% female, mean age 32) were randomly assigned to condition in a 2 (identifying information or not) × 2 (grouped or unified) design. For half the participants, each potential recipient was displayed as a photograph with information below about age, first name, and likelihood of transplant success (low or high, see Figure S1). The remaining participants saw no identifying information: patient names and ages were not displayed, leaving only likelihood of transplant success and, instead of a photo, a grey box with “patient [number]” was displayed. Patients were grouped under the titles “Mountainview Hospital” and “Sunnyvale Hospital” (grouped condition) or “Mountainview-Sunnyvale Hospital” (unified condition).

A 2 × 2 logistic regression on percentage of participants who allocated all kidneys to high-likelihood patients revealed a large main effect of identifying information, X^2=46.87, $p < .0001$, a main effect of grouping, X^2=4.16, $p = .041$, and no significant interaction, X^2=0.90, p =.34 (see Table 2). Thus, the grouping manipulation made participants less efficient, and this effect was not diminished when identifying information was removed. Two additional studies reported in the SOM replicate this grouping effect.

Study 3

Study 3 examined causal mechanisms underlying the grouping effect. It is possible that participants in Study 2 inferred a structural disparity between the two groups, which caused them to allocate less efficiently in the grouped condition. We rule out this account by using birthday months, which are uninformative as to possible structural disparities, as the group labels in Study S2 (see SOM). In Study 3, to further rule out this account, we used labels for the two groups that convey no information that was not already conveyed by the individual patient information. Specifically, the groups were labeled simply as high or low chance of success. In addition, after participants made their allocation decision, they gave open-ended responses about how they allocated the kidneys and rated two items about fairness. We examined these responses as possible mediators of the grouping effect.

Participants (N = 1000, 42% female, mean age 31) were randomly assigned to condition in a 2 (unified or grouped) × 2 (counterbalance condition) design. Each patient was displayed with a photograph, first name, and chance of transplant success (high or low). We counterbalanced whether the patients on the left or right of the screen were designated as having a high chance of transplant success. In the grouped condition, the groups were labeled “high chance of success” and “low chance of success,” while in the unified condition, a centered label read “low and high chance of success.” After allocating the kidneys, participants answered an open-ended question about how they made their allocation decisions and then used a 7-point rating scale to indicate the extent to which they thought about each of two factors: “Kidneys should be distributed equitably,” and “It's not fair for one group to monopolize all the kidneys.” Finally they answered three attention check questions and provided demographic information. The Study 3 materials and analysis plan were preregistered at OSF (osf.io/k29e6).

Four participants were excluded from analysis—three for giving incorrect answers to two of three comprehension check questions, and one because she or he allocated seven kidneys instead of six. A 2 × 2 logistic regression on percentage of participants who allocated all kidneys to high-likelihood patients revealed a main effect of grouping, X^2=14.62, lnOR=0.29, 95%CI [0.14, 0.44], p =.0001, indicating that, compared to the grouped condition, participants in the unified condition were more likely to be perfectly efficient in their allocation (see Table 2). In addition, participants allocated kidneys more efficiently when the patient pictures on the right side of the screen had the high likelihood of success, X^2=5.48, lnOR=0.18, 95%CI [0.03, 0.32], p =.019, but there was no interaction, X^2=1.93, lnOR= −0.10, 95%CI [−0.25, 0.04], p =.16.

Responses to the two fairness rating questions were perfectly correlated with each other (r=1.00). A bias-corrected bootstrap mediation model (Hayes, 2009) with 5,000 resamples indicated that the indirect effect of grouping via fairness ratings was only marginal, 95%CI [−0.1081, +.0026], p=.08.

Open-ended responses about how participants made allocation decisions were coded by a coder naive to the study design and hypotheses and by the first author. Inter-rater agreement was 89%, and analyses were performed on codes from the naïve rater. Responses were coded as mentioning chance of transplant success (85% of responses), fairness (6%), or individual characteristics of the patients, including age, gender, race, and physical appearance (e.g., “I considered their race, sex and appearance.”) (16%). A single participant could receive multiple codes. Although frequency of transplant success reasons differed only marginally between the grouped (83%) and unified conditions (88%, X^2=3.80, p=.051), and frequency of fairness reasons did not differ at all (8% vs. 5%, X^2=2.34, p=.13), frequency of mention of individual characteristics of the patients was higher in the grouped condition (20%) than in the unified condition (13%, X^2=9.05, p=.0026). Furthermore, a bias-corrected bootstrap mediation model with 5,000 resamples indicated that mention of individual characteristics mediated the grouping effect on efficient kidney allocation, 95%CI [−0.216, −0.046].

Discussion

Decision makers are less efficient when allocating organs between groups than when allocating them across individuals, and are also less efficient when risk information is provided at the group vs. individual level (Study 1). Dividing beneficiaries into groups decreases the efficiency of resource allocation decisions because decision makers tend to spread the resource across the groups (Studies 2 and 3). The grouping manipulation decreases efficiency of allocation when the group labels are informative (hospitals names, Experiment 2), clearly uninformative (birthday months, Experiment S2), or redundant (risk information, Experiment 3). Even the least informative of groupings is sufficient to create a perception of groups that leads to changes in kidney distribution.

The grouping effect may occur because decision makers apply an equality heuristic (Messick & Schell, 1992) or a 1/N rule (Gigerenzer, 2008) to allocation problems, and these heuristics are more applicable when the beneficiaries are presented in groups. The mediation analysis in Study 3 indicates that when beneficiaries are divided into groups, decision makers are more likely to appeal to any available individual characteristics, such as race, gender, or appearance, when making allocation decisions, and, as a result, they are less likely to allocate all the kidneys to the patients with a high chance of success. It seems that grouping makes decision makers reluctant to allocate all the resources to one group, and hence they look for individuating characteristics of the beneficiaries that will justify giving some of the kidneys to individuals in the low prognosis group. When individuating characteristics are not available, as in the no-identifying-information condition of Study 2, however, participants nevertheless still give some of the kidneys to individuals in the low prognosis group. The appeal to individuating characteristics therefore appears to be a rationalization rather than the true basis for spreading the scarce resource across groups.

Although in the case of organ allocation, dividing resources across groups led to the undesirable outcome of reduced efficiency, there are other situations where grouping may lead to more desirable outcomes in scarce resource allocation. Recent work by Bohnet, van Green, and Bazerman (2015) demonstrated that gender bias was reduced when presenting a group as small as two employees for evaluation rather than a single employee. This suggests that if managers making decisions about hiring or promoting employees were to have candidates grouped by gender instead of presented as individuals, they might be prompted to spread jobs across the groups more evenly, leading to the hiring or promotion of more women.

While dividing resources across groups may be beneficial in many situations, allowing decision makers to spread risk or reduce unwanted inequities, decision makers over-apply such heuristics. When tough choices about the allocation of scarce life-saving resources need to be made, although grouping potential beneficiaries may seem to help simplify a complex allocation decision, such grouping may have the unexpected side effect of significantly reducing allocation efficiency.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Mean (SD) kidneys allocated efficiently (to potential recipients with a high likelihood of success) and percentage of participants who allocated all 6 kidneys efficiently in Study 1

Allocation Decisions	Mean (SD) kidneys allocated efficiently		Percentage of participants allocating kidneys perfectly efficiently	
	Likelihood of Success Information		Likelihood of Success Information	
	Group	Individual	Group	Individual
Group level allocation	4.79 (1.17)	5.00 (1.23)	40%	55%
Individual level allocation	5.10 (1.12)	5.51 (0.96)	52%	75%

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Table 2

Mean (SD) kidneys allocated efficiently (to potential recipients with a high likelihood of success) and percentage of participants who allocated all 6 efficiently

	Mean (SD) kidneys allocated efficiently		Percentage of participants allocating kidneys perfectly efficiently	
	Grouped	**Unified**	**Grouped**	**Unified**
Study 2				
Identifying Information	4.53 (1.30)	4.80 (1.35)	31%	39%
No Identifying Information	5.30 (1.36)	5.69 (0.93)	73%	87%
Study 3				
High Success on Right	5.29 (1.20)	5.63 (0.95)	71%	85%
High Success on Left	5.23 (1.28)	5.45 (1.10)	68%	76%